

*A Finely Crafted O'Brien Unit 1 Opportunity Day*

**Calculator Section:** You may use a calculator. Show all work and circle your answer. Use your time wisely; you will be able to earn additional credit after the timed portion of the test by completing Supercorrections. When you finish, put away your calculator and you can come up to get the non-calculator part- you may continue to work on both sections without your calculator.

1. Given  $f(x) = 2x - 7$  and  $g(x) = x^2 - 1$ . Find:

a.  $g(f(5))$

b.  $g(t - 1)$

2. Consider the function  $q(x) = -|x - 80| + 2$ .

a. Determine the intervals over which it is increasing, decreasing, or constant.

b. Find any relative minimum or relative maximum values.

c. Find the zeros of the function.

3. Find the equation of the perpendicular bisector of the segment connecting  $(-2, 3)$  and  $(4, 15)$ .

4. The functions  $f(x)$  and  $g(x)$  are given by  $f(x) = \sqrt{x-2}$  and  $g(x) = x^2 + x$ . The function  $(f \circ g)(x)$  is defined for all real numbers, except for the interval  $a < x < b$ . Calculate the value of  $a$  and  $b$ .

5. Consider the function  $f(x) = \frac{2x-1}{x+2}$ .

a. Find the **domain** of  $f$ .

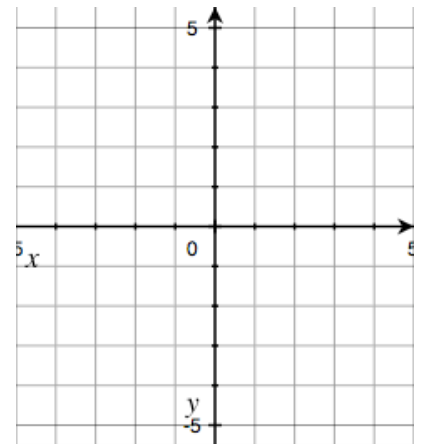
b. Find the **inverse** of  $f$  and use it to find the **range** of  $f$ .

6. Consider the piecewise-defined equation.

$$y = \begin{cases} x^2 & \text{if } x < -1 \\ 1 & \text{if } -1 < x \leq 0 \\ \llbracket x \rrbracket & \text{if } x \geq 0 \end{cases}$$

a. Sketch the graph of the equation.

b. Is the equation a function? Why or why not?

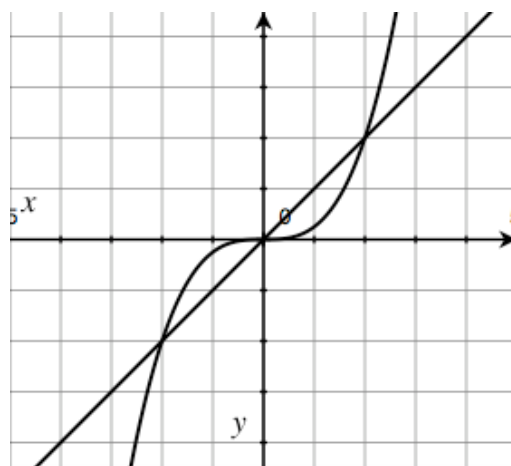


7. Consider the functions  $f(x) = 0.25x^3$  and  $g(x) = x$  graphed at right.

a. Find  $(f - g)(x)$ .

b. Find  $(f - g)(1)$ .

c. Graph  $(f - g)(x)$  on the same axes.



8. Given that  $f(3) = 4$ , evaluate:

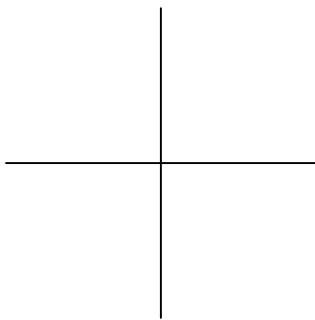
a.  $f^{-1}(4)$

b.  $f(f^{-1}(4))$

c.  $f^{-1}(f(3))$

9. Nick is trying to find the inverse of  $g(x) = (x - 1)^2 + 2$ ,  $x \leq 1$ . His work is at right.

a. Sketch  $g(x)$  and  $h(x)$  on the same axes (rough sketch is fine).



$$y = (x - 1)^2 + 2$$

$$x = (y - 1)^2 + 2$$

$$x - 2 = (y - 1)^2$$

$$\sqrt{x - 2} = y - 1$$

$$1 + \sqrt{x - 2} = y$$

$$\therefore h(x) = 1 + \sqrt{x - 2}$$

b. How does your sketch show that Nick made an error in his working?

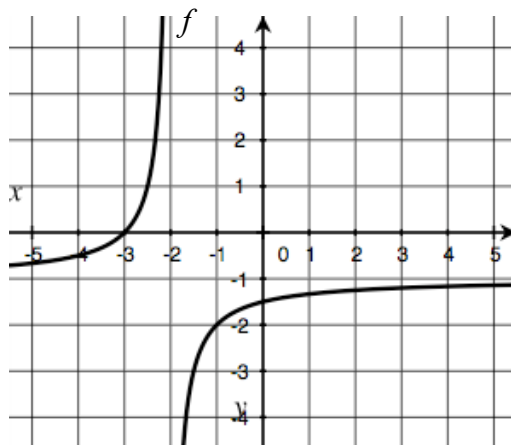
c. Circle the error, and give the correct inverse for  $g(x)$ .

10. The graph of the function  $f(x)$  is shown at right.

a. Find  $f(-3)$  and  $f(-1)$ .

b. Find an equation for  $f(x)$ .

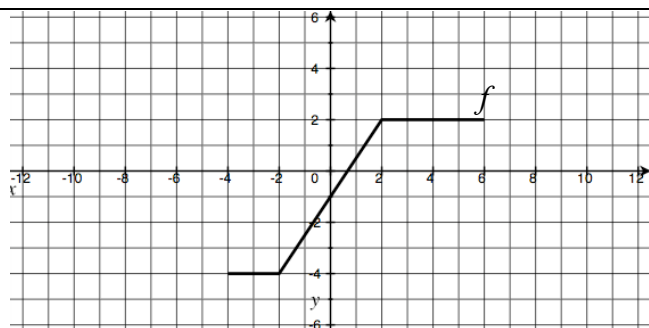
c. Verify your equation by using it to find  $f(-3)$  and  $f(-1)$ .  
Does it match your answer from part a?



11. Consider the interesting function  $f(x)$  graphed at right.

A second function is defined as  $g(x) = f(2x) + 2$ .

a. Find  $g(-2)$ ,  $g(-1)$ ,  $g(0)$ ,  $g(1)$ , and  $g(3)$ .



b. On the same axes, sketch graph of  $g(x)$ .

12. Give a well-structured argument to determine whether  $f(x) = 2x\sqrt{x^2 + 3}$  is even, odd, or neither.

**Bonus:** What is Mr. O'Brien's favorite animal?